

*January 1997*



***Mathematics 33***  
***Grade 12 Diploma Examination***

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**Alberta**  
EDUCATION





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*January 1997*

# **Mathematics 33**

## **Grade 12 Diploma Examination**

### **Description**

Time: 2.5 h. You may take an additional 0.5 h to complete the examination.

This is a **closed-book** examination consisting of

- 37 multiple-choice and 12 numerical-response questions of equal value, worth 70% of the examination
- 4 written-response questions, worth a total of 21 marks or 30% of the examination

Total possible marks: 70

This examination contains sets of related questions

A set of questions may contain multiple-choice and/or numerical-response and/or written-response questions.

A mathematics data booklet is provided for your reference.

The perforated pages at the back of this booklet may be torn out and used for your rough work. No marks will be given for work done on the tear-out pages.

### **Instructions**

- Fill in the information required on the answer sheet and the examination booklet as directed by the presiding examiner.
- You are expected to provide your own scientific calculator.
- Use only an HB pencil for the machine-scored answer sheet.
- If you wish to change an answer, erase **all** traces of your first answer.
- Do not fold the answer sheet.
- Now turn this page and read the detailed instructions for answering machine-scored and written-response questions.



### Multiple Choice

- Decide which of the choices **best** completes the statement or answers the question.
- Locate that question number on the separate answer sheet provided and fill in the circle that corresponds to your choice.

### Example

This examination is for the subject of

- A.** mathematics  
**B.** chemistry  
**C.** biology  
**D.** physics

## Answer Sheet

● (B) (C) (D)

### Numerical Response

- Record your answer on the answer sheet provided by writing it in the boxes and then filling in the corresponding circles.
- If an answer is a value between 0 and 1 (e.g., 0.25), then be sure to record the 0 before the decimal place.
- **Enter the first digit of your answer in the left-hand box and leave any unused boxes blank.**

### Example 1

The value of  $\tan 35^\circ$  to the nearest tenth is

(Record your answer on the answer sheet.)

Value: 0.7002075

Value to be recorded: 0.7

**Record 0.7 on the answer sheet**



### Example 2

The  $y$ -intercept for the quadratic function  $y = 2x^2 + 7x + 32$  is \_\_\_\_\_.

(Record your answer on the answer sheet.)

Value to be recorded: 32

Record 32 on the  
answer sheet

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### Example 3

If an annual interest rate of 7% is compounded quarterly, then the quarterly rate to the nearest hundredth of a percent is \_\_\_\_\_%.

(Record your answer on the answer sheet.)

Value to be recorded: 1.75

Record 1.75 on the  
answer sheet

1	.	7	5
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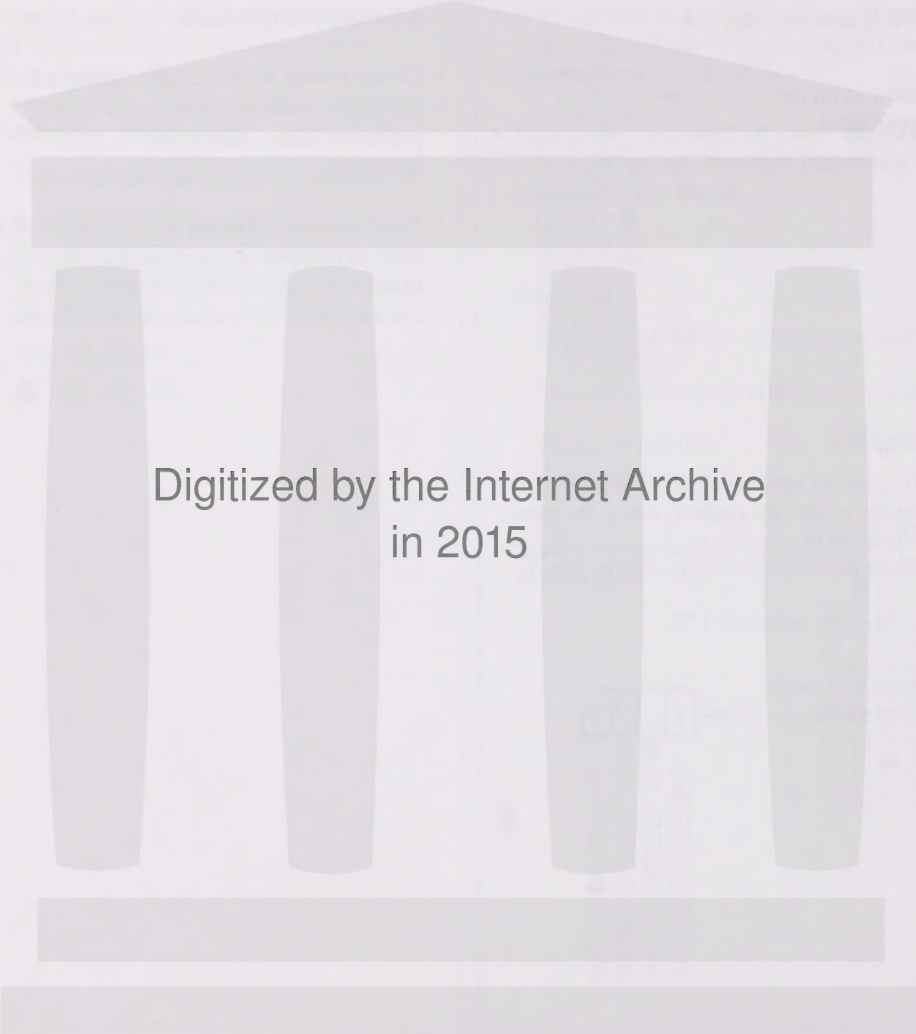
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### Written Response

- Write your answers in the examination booklet as neatly as possible.
- For full marks, your answers must be well organized and address **all** the main points of the question.
- Descriptions and/or explanations of concepts must be correct and reflect pertinent ideas, calculations, and formulas.
- Your answers **should be** presented in a well-organized manner using complete sentences for a written response, and correct units for a numerical response.



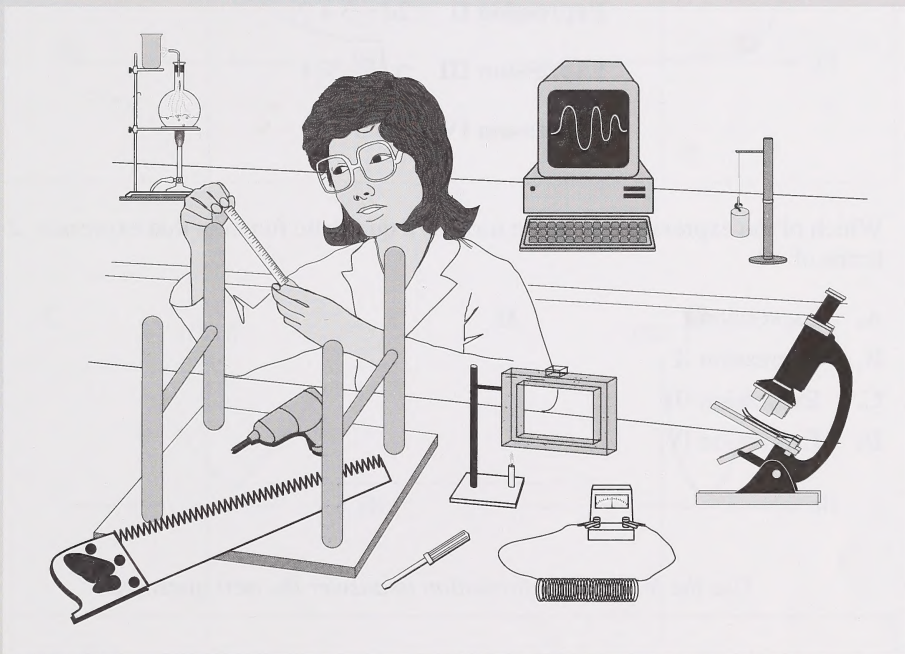


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## CROSS-CURRICULAR CONNECTIONS

Some skills gained in Mathematics 33 are extensions of understanding from previous courses and can be applied to other courses. The following questions are related to the experiences of a student named Lori and require you to use and/or extend your understandings.





Use the following information to answer the next question.

In physics class, Lori's data sheet contained formulas relating distance,  $d$ , measured in metres and time,  $t$ , measured in seconds. Lori substituted values into formulas and simplified them to obtain these expressions:

**Expression I**      $d = 3t + 4.9t^2$

**Expression II**      $2d = 3 + 7t$

**Expression III**      $\sqrt{\frac{d}{4.9}} = t$

**Expression IV**      $\frac{d}{t} = 5$

1. Which of the expressions is in the form of a quadratic function that expresses  $d$  in terms of  $t$ ?
- A. Expression I  
B. Expression II  
C. Expression III  
D. Expression IV
- \_\_\_\_\_

Use the following information to answer the next question.

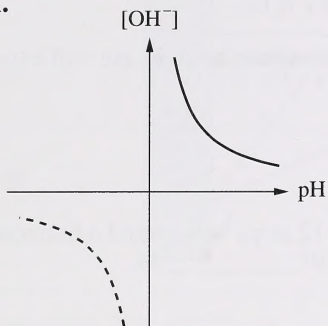
As part of a physics project, Lori determined the stopping time for a vehicle that had been travelling at an initial speed of 10 km/h on a very icy road. Lori used the equation  $25 = 10t - t^2$ , where  $t$  is the time in seconds it takes for a vehicle to come to a stop.

2. The time it would take for the vehicle to stop, to the nearest tenth of a second, is
- A. 2.5 s  
B. 5.0 s  
C. 10.0 s  
D. 12.5 s

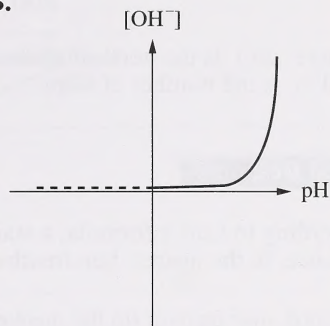


3. Lori's chemistry teacher explained that hydroxide ion concentration  $[\text{OH}^-]$  can be graphed as a function of the measured pH in terms of an **exponential function**. The graph that **best** portrays an exponential relationship is graph

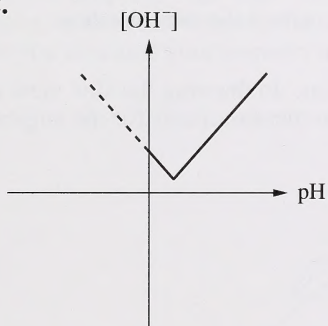
A.



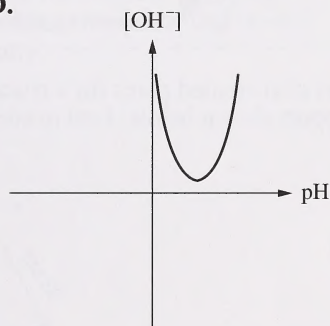
B.



C.



D.



4. Lori drew plans for a door to fit a rectangular opening of area  $24 \text{ m}^2$ . The height of the opening needed to be 2 m more than the width. If  $x$  metres represents the measure of the width, then an equation that can be used to find the width of the door is

- A.  $2x^2 - 24 = 0$
- B.  $x^2 + 2x - 24 = 0$
- C.  $x^2 + 2x + 24 = 0$
- D.  $x^2 + 4x - 20 = 0$



Use the following information to answer the next question.

In a Career and Technology Studies class, Lori planned a staircase using the formula

$$d(n) = 0.2(n - 1) + 0.15,$$

where  $d(n)$  is the horizontal distance in metres that the staircase will extend and  $n$  is the number of steps.

### Numerical Response

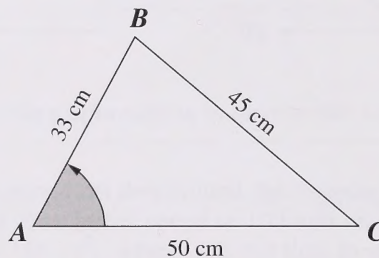
1. According to Lori's formula, a staircase with 12 steps will extend a horizontal distance, to the nearest hundredth of a metre, of \_\_\_\_\_m.

(Record your answer on the answer sheet.)

\_\_\_\_\_

Use the following information to answer the next question.

Lori also created plans for a triangular support. In drawing the side view of the support shown below, Lori needed to include measurements for the angles.



### Numerical Response

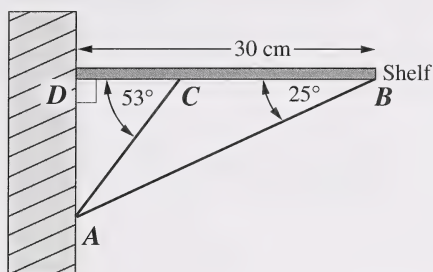
2. The measure of angle A, to the nearest tenth of a degree, is \_\_\_\_\_.

(Record your answer on the answer sheet.)



Use the following information to answer the next question.

Lori built the triangular support system shown below.



**Written Response — 5 marks**

1. Lori built a shelf 30 cm in length. In order to keep it secure, Lori built two supports,  $\overline{AB}$  and  $\overline{AC}$ , as shown in the diagram. Find the lengths, to the nearest tenth of a centimetre, of both supports, and show how you obtained your answers mathematically.



Use the following information to answer the next question.

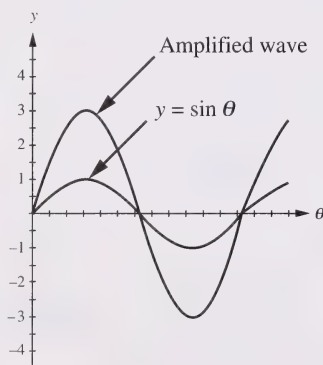
While studying electronics, Lori needed to check the effective resistance ( $R$ ) in a circuit. Lori added the terms in the rational expression

$$\frac{5}{R} + \frac{2}{R-2}$$

5. A simplified form of  $\frac{5}{R} + \frac{2}{R-2}$ , where  $R \neq 0$  or  $2$ , is

- A.  $\frac{5R-10}{R-2}$   
B.  $\frac{7}{2R-2}$   
C.  $\frac{7}{R(R-2)}$   
D.  $\frac{7R-10}{R(R-2)}$

Use the following information to answer the next question.



Lori built a project that related mathematics to operating a radio station. Lori determined that an Amplified Modulation station (AM radio station) transmits a signal by changing the amplitude of the sine wave, as represented by the equation  $y = \sin \theta$  and shown in the graph on the left.

6. The graph of the amplified wave above appears to be a representation of the equation
- A.  $y = \sin \theta - 3$   
B.  $y = \sin \theta + 3$   
C.  $y = \sin 3\theta$   
D.  $y = 3 \sin \theta$



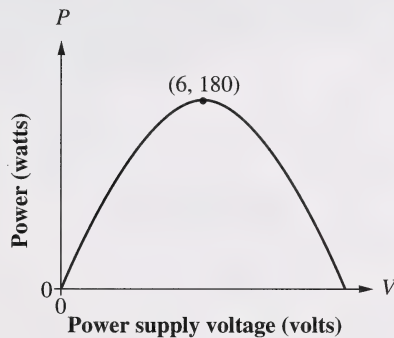
Use the following information to answer the next question.

Lori learned that a radio station manager planned to sponsor a rock concert and raise ticket prices to a certain amount. Lori knew that the profit  $P(t)$  is determined by the quadratic function  $P(t) = -320(t - 3)^2 + 8\,000$ , where  $t$  represents the increase in ticket price in dollars. Lori informed the radio station manager that the proposed increase would result in zero profit,  $P(t) = 0$ .

7. The price increase per ticket that the manager proposed was
- A. \$3
  - B. \$8
  - C. \$11
  - D. \$25
- 

Use the following information to answer the next question.

Lori used a quadratic function to produce the following display. The graph relates power supply voltage,  $V$ , to power in watts,  $P$ .



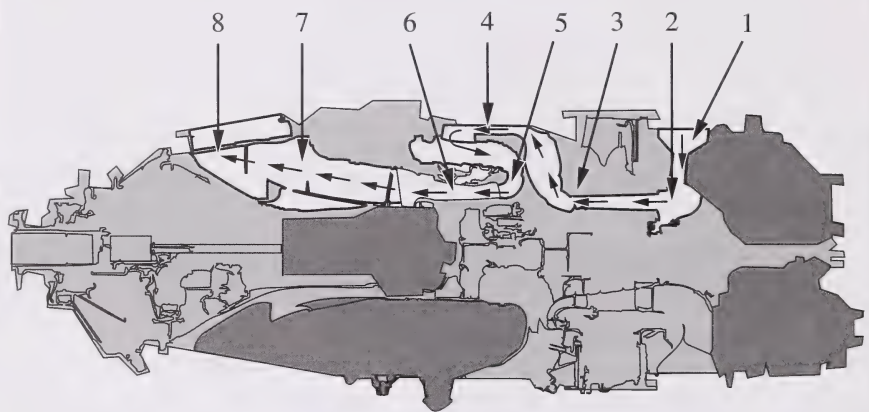
8. The quadratic function that could be used to produce the graph above is
- A.  $P = -5(V - 6)^2 + 180$
  - B.  $P = -5(V - 6)^2 - 180$
  - C.  $P = -5(V + 6)^2 - 180$
  - D.  $P = -5(V + 6)^2 + 180$



As a work experience student, Lori assisted an aircraft technician by applying her understanding of graphing and interpreting relations and functions.

Use the following information to answer the next question.

A technician at an Alberta company manufacturing aircraft engines carries out several repeated tests of each engine to insure its durability and efficiency. During one test, data related to the temperature and pressure of air at various positions as it moves through the aircraft engine were recorded. The location of each reading is shown in the diagram and listed in the table below.

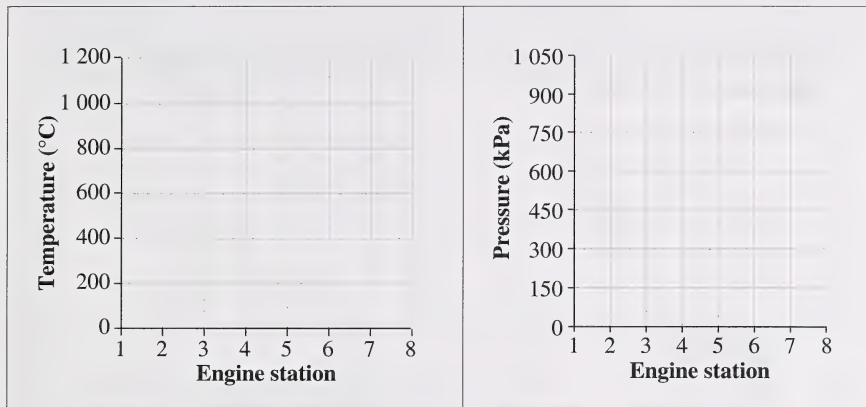


Engine Station	Engine Process	Temperature (°C)	Pressure (kilopascals kPa)
1	Air intake	15	101.4
2	Air compression	18.8	103.4
3	Compressed air discharge	117	258.6
4	Combustion stage “a”	322	902.6
5	Combustion stage “b”	1 055	884.63
6	Cooling of gas/air and power generation	777	275.8
7	Exhaust stage “a”	646	110.3
8	Exhaust stage “b”	589	106.9

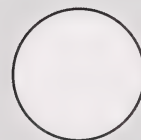


**Written Response — 5 marks**

2. a. On the two grids provided below, plot the data from the table provided. On the first grid, show the relationship of temperature to engine station number. On the second grid, show the relationship of pressure in kilopascals to engine station number.



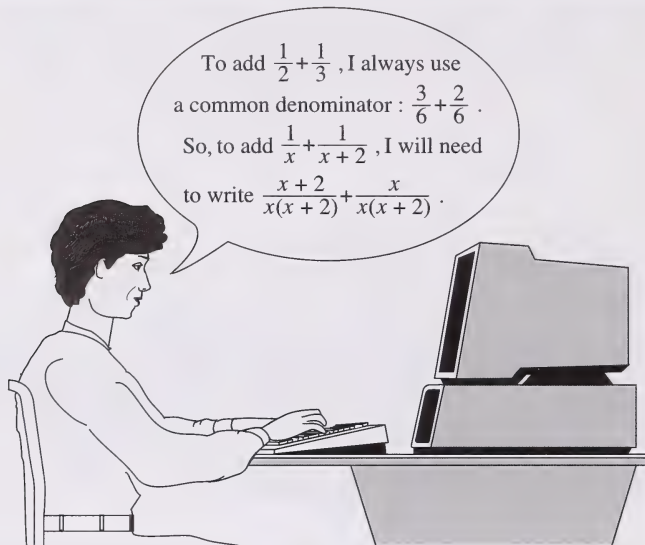
- b. Use the table or the graphs to explain how temperature and pressure change starting at station 1 and progressing to station 8, one station at a time. Also note any minimum and maximum values.





## CONNECTIONS

Lance decided to attend a post-secondary institution to become an aircraft technician. In reviewing basic operations and procedures required to solve problems, Lance connected procedures used to simplify radical and rational expressions to procedures used to simplify fractions and polynomials. Use these connections to solve the following eight questions.



## Numerical Response

3. When  $\sqrt{45}$  is expressed in mixed radical form  $a\sqrt{b}$ , where  $a$  and  $b$  are whole numbers, the largest value of  $a$  is \_\_\_\_\_.

(Record your answer on the answer sheet.)

9. The expression  $10\sqrt{6} + \sqrt{48} - 8\sqrt{3} + \sqrt{54}$  is written in the form  $a\sqrt{b} - 4\sqrt{3}$ , where  $a$  and  $b$  are whole numbers. The value for  $a$  is
- A. 9  
B. 13  
C. 14  
D. 19



Use the following information to answer the next question.

Lance noted that multiplying two binomial radicals is linked to multiplying two binomial polynomials, as in the example  $(x + 2)(x + 3) = x^2 + 5x + 6$ .

10. A correct expansion of the product  $(\sqrt{3} + \sqrt{2})(\sqrt{5} - \sqrt{x})$  is
- A.  $\sqrt{15} + \sqrt{3x} + \sqrt{10} - \sqrt{2x}$
  - B.  $\sqrt{15} + \sqrt{3x} - \sqrt{10} + \sqrt{2x}$
  - C.  $\sqrt{15} - \sqrt{3x} - \sqrt{10} + \sqrt{2x}$
  - D.  $\sqrt{15} - \sqrt{3x} + \sqrt{10} - \sqrt{2x}$
- 
11. If  $\frac{4 + \sqrt{10}}{\sqrt{2}}$  is rationalized to the equivalent form  $2\sqrt{2} + c\sqrt{d}$ , where  $c$  and  $d$  are whole numbers, then the value of  $d$  is
- A. 2
  - B. 5
  - C. 8
  - D. 10

*Lance connected polynomial factoring skills to determining non-permissible values and simplifying rational expressions.*

12. The non-permissible values of  $x$  for the expression  $\frac{x^2 - 9}{x^2 + 8x + 15}$  are
- A. 5 and 3
  - B. 5 and  $-3$
  - C.  $-5$  and 3
  - D.  $-5$  and  $-3$



13. A simplified form of  $\frac{v^2+7v+12}{4v+12}$ , where  $v \neq -3$ , is
- A.  $\frac{v+3}{3}$   
B.  $\frac{v+3}{4}$   
C.  $\frac{v+4}{3}$   
D.  $\frac{v+4}{4}$
14. A simplified form of  $\frac{x^2+5x+6}{x^2+6x+8} \times \frac{x^2-16}{x^2+3x}$ , where  $x \neq -2, -4, -3$  or  $0$ , is
- A.  $\frac{x+4}{x}$   
B.  $\frac{x-4}{x}$   
C.  $\frac{-5}{3x+14}$   
D.  $\frac{-10}{3x+8}$

### Numerical Response

4. For the rational equation  $\frac{x+10}{x} = 9$ , where  $x \neq 0$ , the value of  $x$ , to the nearest hundredth, is \_\_\_\_\_.

(Record your answer on the answer sheet.)



## TECHNOLOGY

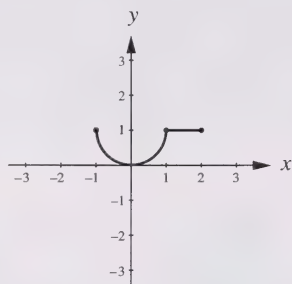
Graphing calculators, computers, and other forms of technology are of great assistance in analyzing, interpreting, and exploring equations and their graphical representations. Use your knowledge of angles on a coordinate plane, quadratics, and transformations to answer the next set of questions.





Use the following information to answer the next question.

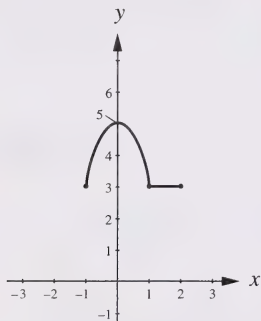
The graph of  $y = f(x)$  is shown below.



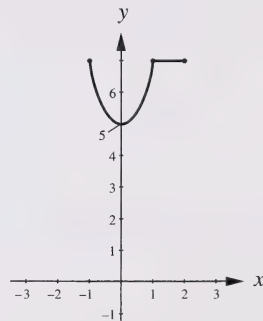
Use your understanding of graphical transformations associated with  $y = a \cdot f(x - h) + k$  to answer the next question

15. If  $y = f(x)$  is changed to  $y = -2f(x) + 5$ , then the transformed graph is best illustrated by

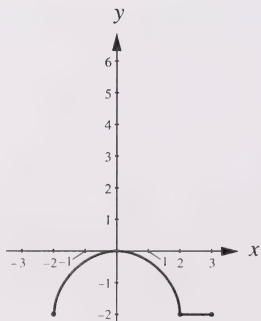
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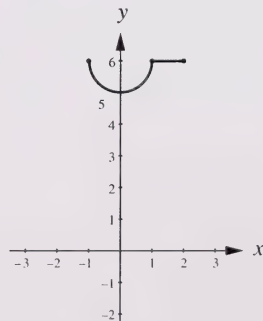
B.



C.



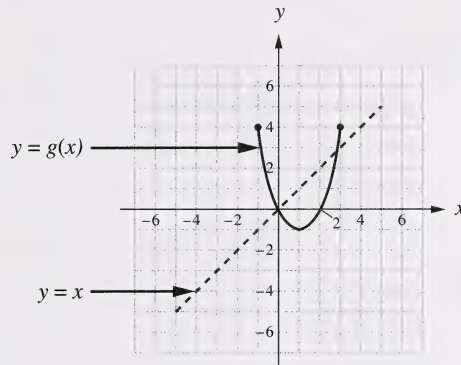
D.





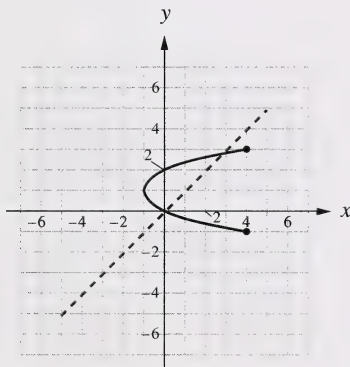
Use the following information to answer the next question.

The graph of the function  $y = g(x)$  is shown below.

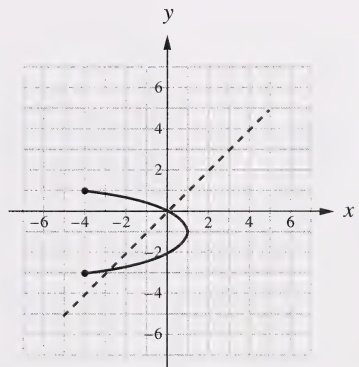


16. Which of the following is the graph of the inverse of the function graphed above?

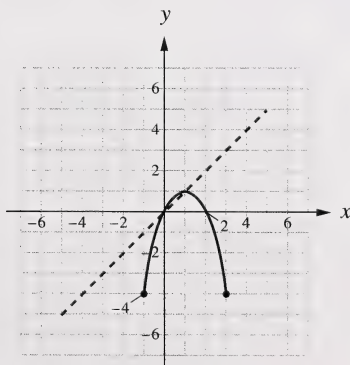
A.



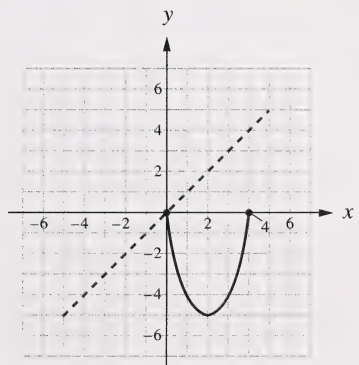
B.



C.



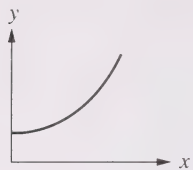
D.



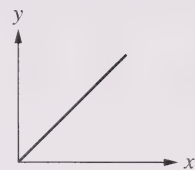


17. Which graph does **not** represent a function?

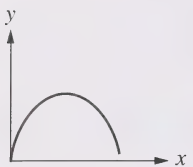
A.



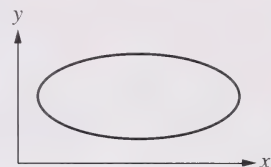
B.



C.

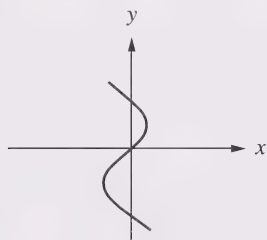


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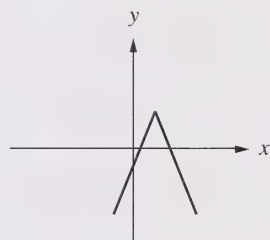


18. The graph below that **best** represents an absolute value function is

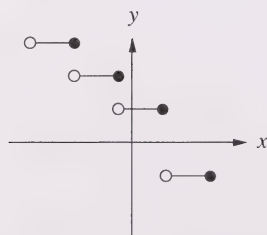
A.



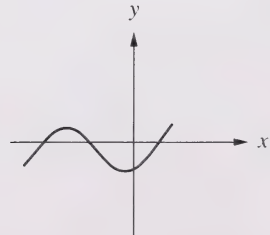
B.



C.



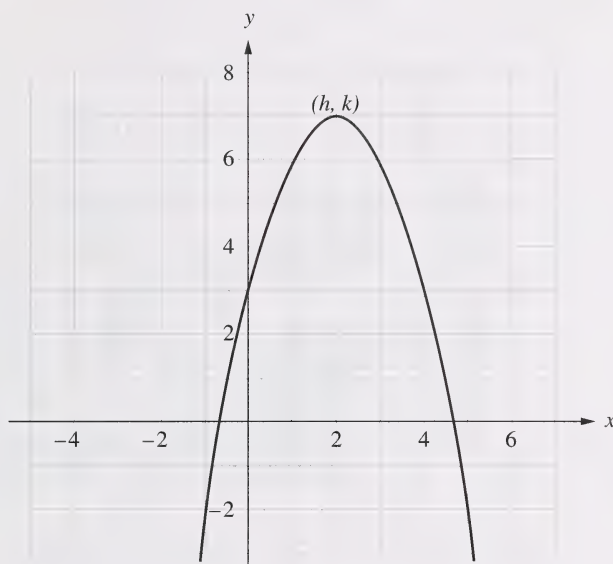
D.





Use the following information to answer the next two questions.

The graph of a quadratic function that has a vertex at  $(h, k)$  is shown below.



19. The quadratic function that could be used to describe the graph is of the form

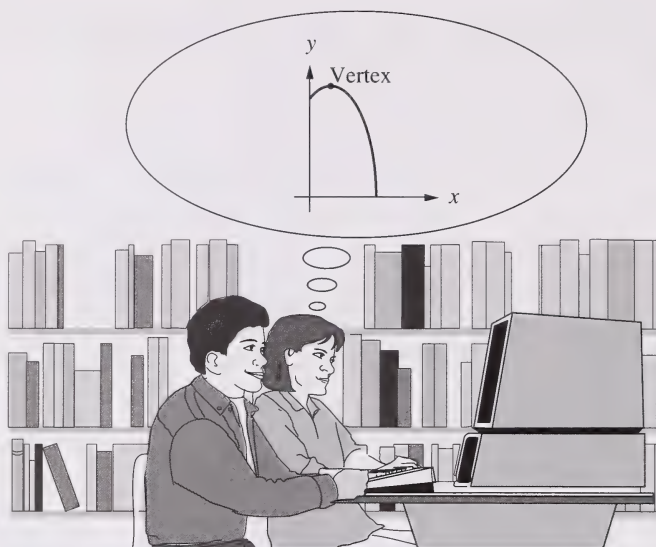
- A.  $f(x) = -(x - h)^2 + k$
- B.  $f(x) = (x - h)^2 + k$
- C.  $f(x) = -(x + h)^2 + k$
- D.  $f(x) = (x + h)^2 + k$

20. The range of the function illustrated in the graph above is of the form

- A.  $y \leq h$
- B.  $y \geq h$
- C.  $y \geq k$
- D.  $y \leq k$



Use the following information to answer the next question.



Samantha and Sydney were looking for the important points related to the graph of  $y = -2x^2 + 8x + 10$ . When determining the vertex, Samantha began completing the square as shown below.

**Step 1:**  $y = -2x^2 + 8x + 10$

**Step 2:**  $y = -2(x^2 - 4x + \underline{\hspace{1cm}}) + 10$

**Step 3:**  $y = -2(x^2 - 4x + 4) + 10 + 8$

**Step 4:**  $y = -2(\underline{\hspace{2cm}})^2 + \underline{\hspace{2cm}}$

**Step 5:** Vertex is  $(\underline{\hspace{1cm}}, \underline{\hspace{1cm}})$

**Written Response – 6 marks**

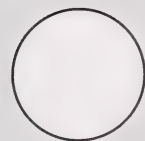
3. a. Finish Samantha's work in steps 4 and 5 by filling in the blanks below.

**Step 4:**  $y = -2(\underline{\hspace{2cm}})^2 + \underline{\hspace{2cm}}$

**Step 5:** Vertex is  $(\underline{\hspace{1cm}}, \underline{\hspace{1cm}})$



- b. What information from the equation would lead you to conclude the graph opens downward?
- c. Show algebraically where the graph of  $y = -2x^2 + 8x + 10$  crosses the  $x$ -axis. Start your work by stating what the value of  $y$  is at the  $x$ -intercepts.





**Numerical Response**

5. If the vertex of a parabola that opens upward is at  $(10.3, 28.4)$ , then the equation of the axis of symmetry is  $x =$  \_\_\_\_\_.

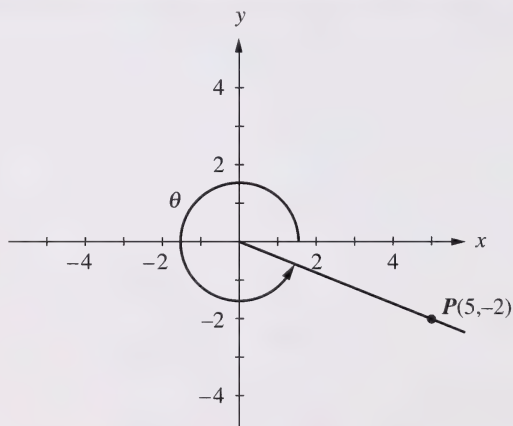
(Record your answer on the answer sheet.)

21. The roots of the equation  $x^2 + 8x + 10 = 0$  are  $x =$

- A.  $-8 \pm \sqrt{13}$
- B.  $-8 \pm \sqrt{6}$
- C.  $-4 \pm \sqrt{13}$
- D.  $-4 \pm \sqrt{6}$

*Use the following information to answer the next question.*

A point  $P(5, -2)$  on the terminal arm of an angle  $\theta$  is shown below.

**Numerical Response**

6. Expressed as a decimal to the nearest hundredth, the cosine ratio for angle  $\theta$  is \_\_\_\_\_.

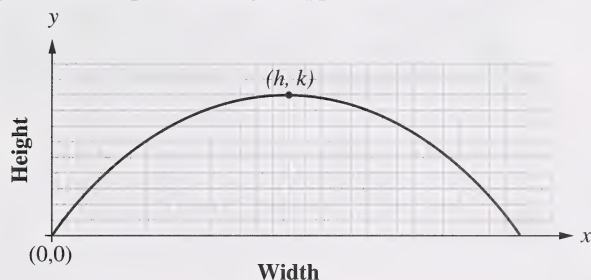
(Record your answer on the answer sheet.)



Workers in a construction company used computers and tables to display plans for the construction of a highway and a bridge.

Use the following information to answer the next two questions.

The parabolic shape obtained from a quadratic function can be used to design arches. A construction company used the quadratic function  $f(x) = a(x - h)^2 + k$  and the graph below to plan a bridge support for a road.



22. The maximum height of the bridge support is

- A.  $h$
- B.  $a$
- C.  $x$
- D.  $k$

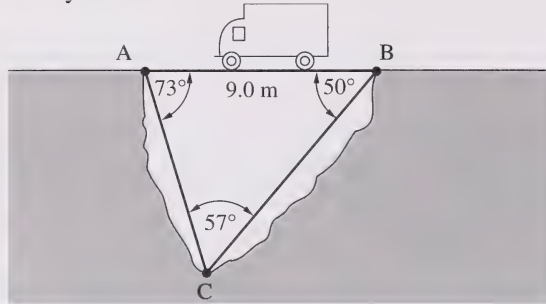
23. The total width of the bridge support is

- A.  $h$
- B.  $k$
- C.  $2h$
- D.  $2k$



Use the following information to answer the next question.

The span of a bridge to be constructed between points  $A$  and  $B$  is measured to be  $9.0\text{ m}$  in a survey.



The surveyor noted that from point  $A$ , the angle of depression to point  $C$  is  $73^\circ$ , and from point  $B$ , the angle of depression to point  $C$  is  $50^\circ$ . In order to build the support system, the measures from point  $B$  to point  $C$  and from point  $C$  to point  $A$  needed to be determined.

24. The distance from point  $B$  to point  $C$ , to the nearest tenth, is
- A.  $6.9\text{ m}$
  - B.  $8.2\text{ m}$
  - C.  $10.3\text{ m}$
  - D.  $12.2\text{ m}$



Use the following information to answer the next question.

When they purchased a new paving machine in 1994, the company obtained a 4-year loan for \$90 000.00 at a rate of 10.5% per annum.

**Numerical Response**

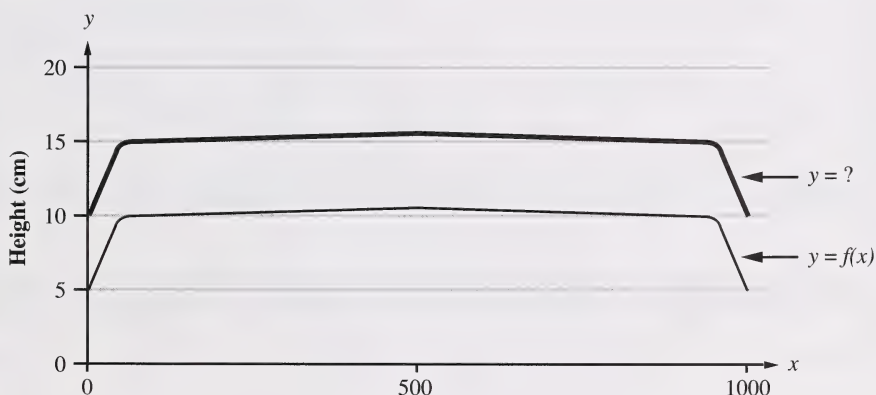
7. The construction company's regular monthly loan payment, to the nearest dollar, would be \$\_\_\_\_\_.

(Record your answer on the answer sheet.)

\_\_\_\_\_

Use the following information to answer the next question.

The cross section of a highway represented by the graph  $y = f(x)$  and the cross section of the same highway with an added 5 cm layer of resurfacing are shown below.



25. The equation of the graph representing the resurfaced highway is
- A.  $y = 2 \cdot f(x)$
  - B.  $y = f(x + 2)$
  - C.  $y = f(x) + 5$
  - D.  $y = 5 \cdot f(x)$



## AIRLINE INDUSTRY

Workers in the airline industry use their mathematical understanding to solve work-related problems and problems associated with everyday life. Use your mathematical understandings to solve the next set of questions, the first of which are related to the personal finances of airline industry employees.





*Use the following information to answer the next question.*

An airline company employee contributes \$5 000 at the beginning of each year, for 20 years, into the company's annuity plan, which earns 8% per annum calculated annually.

26. The value of the employee's annuity after 20 years, rounded to the nearest dollar, is
- A. \$49 091
  - B. \$108 000
  - C. \$122 065
  - D. \$247 115
- 

*Use the following information to answer the next question.*

A pilot for the airline company arranged a \$100 000 mortgage to buy a condominium. She considered financing the mortgage over 20 years at an interest rate of 9% per annum.

27. The pilot will have to make regular monthly payments of
- A. \$454.17
  - B. \$750.00
  - C. \$873.82
  - D. \$889.19



*Use the following information to answer the next question.*

Sydney borrowed \$2 000.00 at 12% per annum compounded monthly to buy a car. Sydney's payments are \$178.00 monthly for one year, with the interest calculated monthly. At the end of one year, the loan is fully paid off. To analyze the loan payments, Sydney set up the following amortization spreadsheet and made the first several entries.

Monthly Payment Periods	Amount Paid/Month	Interest Paid/period	Principal Paid	Outstanding Balance
0				\$2 000.00
1	\$178.00	$\$2\,000.00 \times 0.01$ $= \$20.00$	$\$178.00 - \$20.00$ $= \$158.00$	\$1 842.00
2	\$178.00	$\$1\,842.00 \times 0.01$ $= \$18.42$	$\$178.00 - \$18.42$ $= \$159.58$	\$1 682.42
3	\$178.00	<i>A</i>	\$161.18	\$1 521.24
4	\$178.00	<i>B</i>	<i>C</i>	<i>D</i>

**Written Response — 5 marks**

- 4.** a. Determine *A*, *B*, *C*, and *D* in the amortization table, and show how you obtained these values.
- b. Find the total amount of interest paid in the first year, and show how you determined it.



*Use the following information to answer the next question.*

Another employee, Lee, wanted to obtain a loan for a car purchase. Lee compared monthly payments offered by two different financial institutions, one charging 10.5% per annum and the other charging 9.75% per annum on 4-year loans.

28. In comparing the two rates, Lee knew that as the rate of interest on a loan drops, the amount of the monthly payment is
- A. unchanged
  - B. amortized
  - C. increased
  - D. decreased
- \_\_\_\_\_

*Use the following information to answer the next question.*

The airline company wanted to know whether employees would prefer a four-day workweek. They randomly asked 20 of the workers, "Would you prefer a four-day workweek?" Of the workers surveyed, 12 said "yes."

### **Numerical Response**

8. Using the sample above and a 90% box plot chart to create a confidence interval, the company determined that the **least** percentage of workers they could expect to say "yes" to a four-day workweek was \_\_\_\_\_%.

(Record your answer on the answer sheet.)

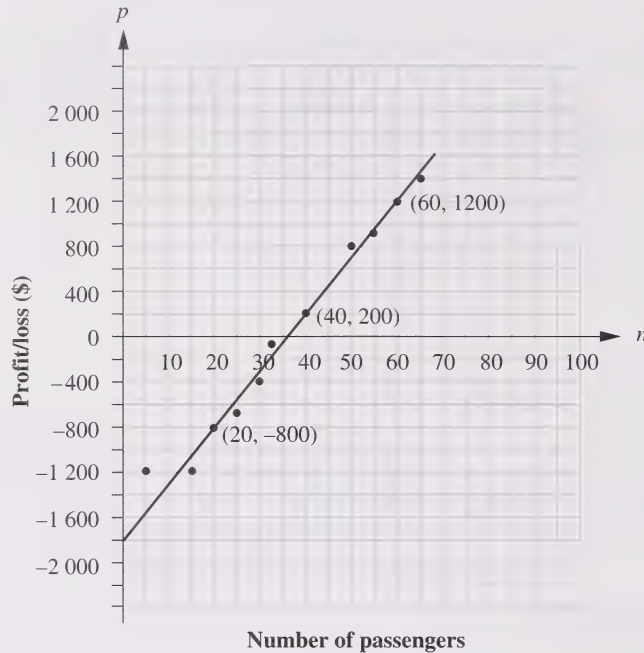
\_\_\_\_\_

29. The airline company knew that 70% of all their passengers in 1996 were pleased with the meal service on their flights. If 40 passengers on a flight were sampled in 1996, the 90% confidence interval for the number who were satisfied with the meal service is between
- A. 11 and 17
  - B. 20 and 35
  - C. 23 and 33
  - D. 24 and 32



Use the following information to answer the next question.

The airline company offered flights from Calgary to Edmonton. A company aircraft had a capacity of 65 passengers. In order to analyze the profitability of flying the aircraft, a scatter plot relating the number of passengers,  $n$ , to the profit/loss in dollars,  $p$ , has been drawn below. A line of best fit is included.

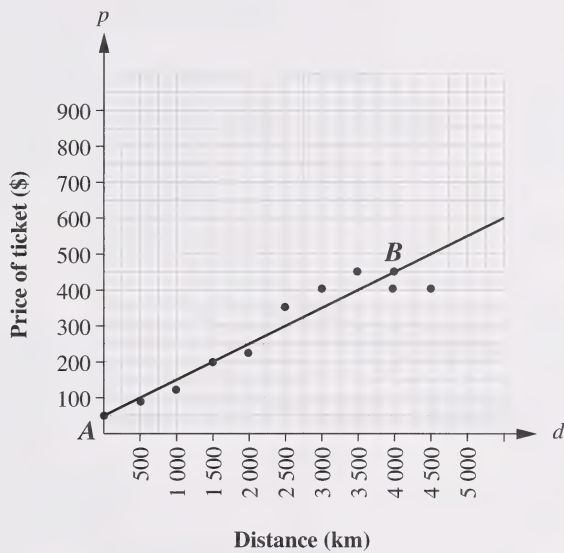


30. The apparent correlation between the number of passengers and the profit margin described by the scatter plot above is
- A. zero
  - B. weak
  - C. positive
  - D. negative



Use the following information to answer the next question.

The airline company used the scatter plot shown below to illustrate the relationship between the price,  $p$ , in dollars of a one-way ticket and the distance,  $d$ , in kilometres of the flight.



31. If two of the points on the line of best fit are  $A(0, 50)$  and  $B(4\ 000, 450)$ , then the equation of the line of best fit is

A.  $p = \frac{1}{10}d + 50$

B.  $p = 10d + 50$

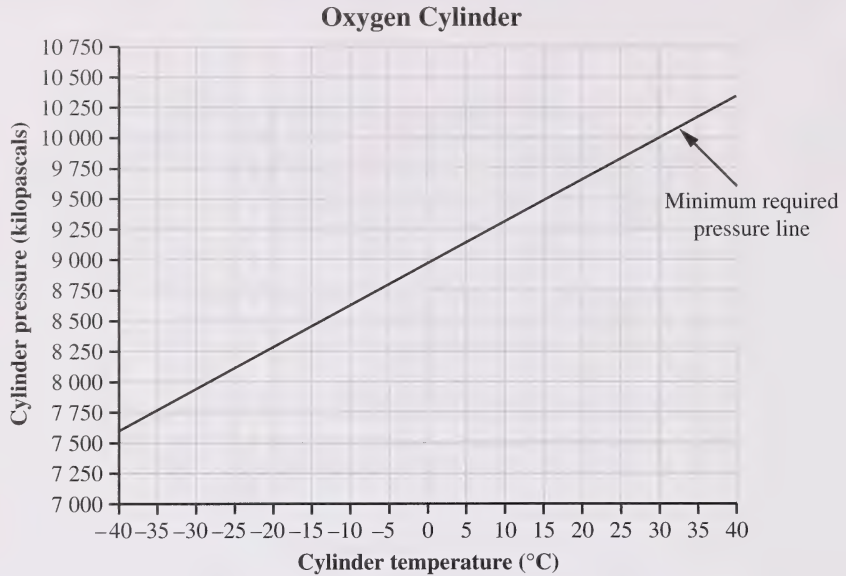
C.  $p = \frac{1}{10}d$

D.  $p = 50$



Use the following information to answer the next two questions.

Before an aircraft is granted permission to take off, the pressure in the oxygen cylinders must meet a minimum safety level. The graph below shows the relationship between temperature and minimum required pressure.



32. The independent variable is the

- A. range
- B. y-intercept
- C. cylinder pressure
- D. cylinder temperature



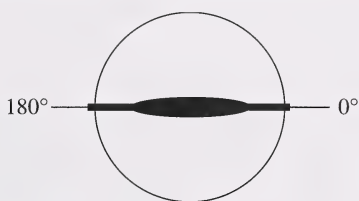
Use the following additional information to answer the next question.

On a day when the cylinder temperature was  $20^{\circ}\text{C}$ , the pressure of a cylinder was 9 300 kilopascals.

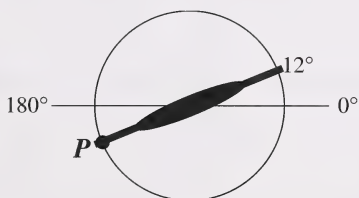
33. Which statement below is true for a pressure of 9 300 kilopascals at  $20^{\circ}\text{C}$ ?
- A. The pressure exceeds minimum requirements.
  - B. The pressure is below the minimum requirements.
  - C. The pressure is sufficient for approval.
  - D. The pressure is exactly the minimum required.
- 

Use the following information to answer the next question.

A plane in level flight registers on the “Turn and Bank Indicator” as shown.



When turning or banking left, the indicator changes to



The position of the indicator at point **P** determines a positive angle in standard position.

### Numerical Response

9. The measure of the positive angle at point **P** is \_\_\_\_\_ $^{\circ}$ .

(Record your answer on the answer sheet.)



Use the following information to answer the next question.

A stunt pilot used rotations on a coordinate plane to describe the rotation of a wing tip through  $360^\circ$ . During one stunt, a wing tip was rotated  $-70^\circ$ .

**Numerical Response**

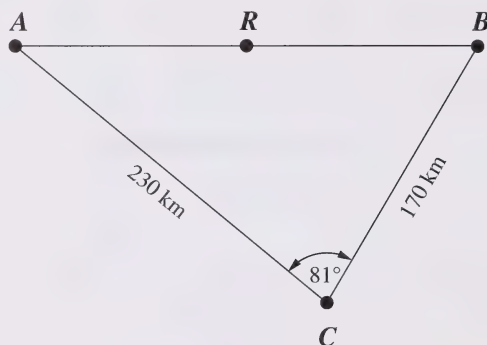
10. The angle between  $0^\circ$  and  $360^\circ$  that is coterminal with  $-70^\circ$  is \_\_\_\_\_  $^\circ$ .

(Record your answer on the answer sheet.)

\_\_\_\_\_

Use the following information to answer the next question.

An airfield is located at point  $R$ , exactly halfway between points  $A$  and  $B$ .



Use a trigonometric law to solve the following problem.

**Numerical Response**

11. The distance from point  $A$  to point  $R$ , to the nearest kilometre, is \_\_\_\_\_ km.

(Round and record your answer on the answer sheet.)



Use the following information to answer the next question.

During a 1 960 km trip, an aircraft flew against a strong wind for 600 km. When the wind decreased, the plane's ground speed increased by 60 km/h for the remaining 1 360 km. The total trip took 4 hours.

34. If  $x$  represents the ground speed of the plane in km/h flying against the strong wind, then an expression for the time flown by the plane at the faster speed is

A.  $\frac{600}{x+4}$

B.  $\frac{1\,360}{x+4}$

C.  $\frac{1\,360}{x+60}$

D.  $\frac{1\,960}{x+60}$

### Numerical Response

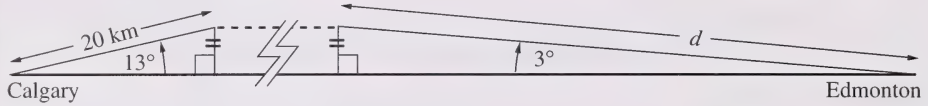
12. The speed,  $s$ , in metres per second, of an aircraft is related to the lift,  $L$ , in newtons, by the radical equation  $s = 0.1\sqrt{L}$ . When the lift is 1 440 000 N, then the speed, to the nearest metre per second, is \_\_\_\_\_m/s.

(Record your answer on the answer sheet.)



Use the following information to answer the next question.

A passenger plane took off from Calgary International Airport and climbed at an angle of  $13^\circ$  for 20 km. It then travelled horizontally at a specific altitude. Later, the plane descended into Edmonton International Airport from the same altitude at an angle of  $3^\circ$ , as shown in the diagram below.

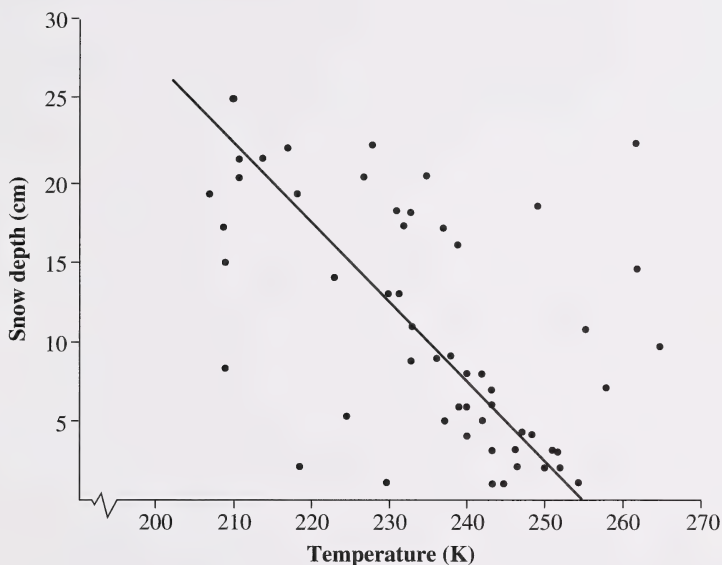


35. The distance ( $d$ ) that the aircraft travelled in the air while descending, to the nearest tenth of a kilometre, is
- A. 20.0 km
  - B. 35.0 km
  - C. 86.0 km
  - D. 88.1 km



Use the following information to answer the next two questions.

The aerospace industry positions satellites that serve many purposes. To help predict potential water resources, a Landsat satellite sends data to Earth relating Arctic snow depth in centimetres to the temperature in Kelvin. A scatter plot of the Landsat data is shown below.



Note:  $0^{\circ}\text{C}$  is equivalent to  $273.15\text{ K}$

36. Which statement correctly describes the above scatter plot?
- A. The scatter plot indicates a strong negative correlation.
  - B. The scatter plot indicates a weak negative correlation.
  - C. The scatter plot indicates a strong positive correlation.
  - D. The scatter plot indicates a weak positive correlation.



37. According to the line of best fit, if the temperature   *i*  , the snow depth will   *ii*  . The row that completes the statement above correctly is row

Row	<i>i</i>	<i>ii</i>
A.	decreases	be zero
B.	decreases	decrease
C.	increases	increase
D.	increases	decrease



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